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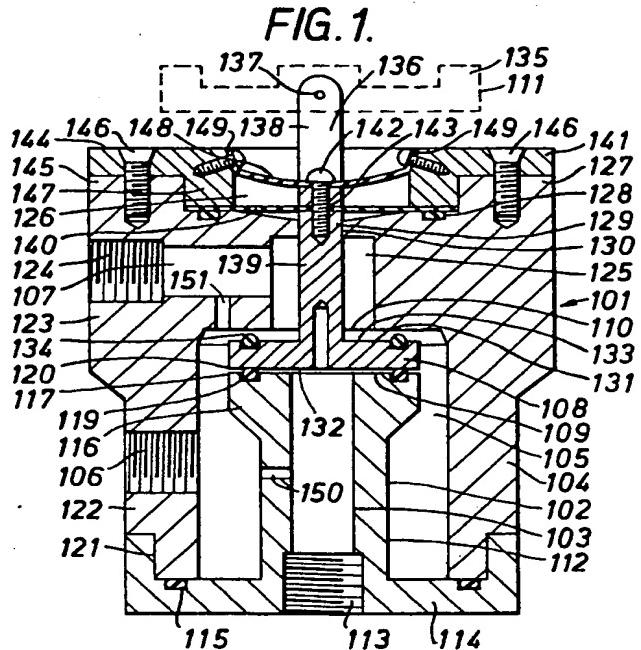
GB A 2116676	GB 1429775	GB 1008653
GB A 2003258	GB 1160618	GB 0827765
GB 1537415	GB 1043716	

(58) Field of search

F2V
Selected US specifications from IPC sub-class F16K

(54) Valve

(57) A valve for controlling fluid flow, particularly gas flow, comprises a body 101 with portions forming passages 103 and 107 and an annular chamber 105 surrounding the passage 103 which is centrally located within the body 101. A valve member 108 common to each passage can close off opposed ends 109 and 110 of the passages 103 and 107 and form a seal (119, 134) therewith, the valve 108 being spring biased by a leaf spring 148 to close off the end 109 of the passage 103. The valve stem 136 is connected to an armature 135 of a solenoid (not shown) serving to move the valve 108 upwardly against the bias. The arrangement is such that the valve 108 can occupy a position in which one passage communicates with the chamber 105 while the other passage is closed by the valve 108 or an intermediate position where both passages communicate with the chamber 105. The valve body 101 has internally threaded external ports 113, 124 and 106 leading respectively to the passages 103, 107 and the chamber 105. By-pass ports 150, 151 are provided. The valve can operate as a flow diverter, a flow proportioning valve, a flow selector, or a mixing device.



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FIG. 1.

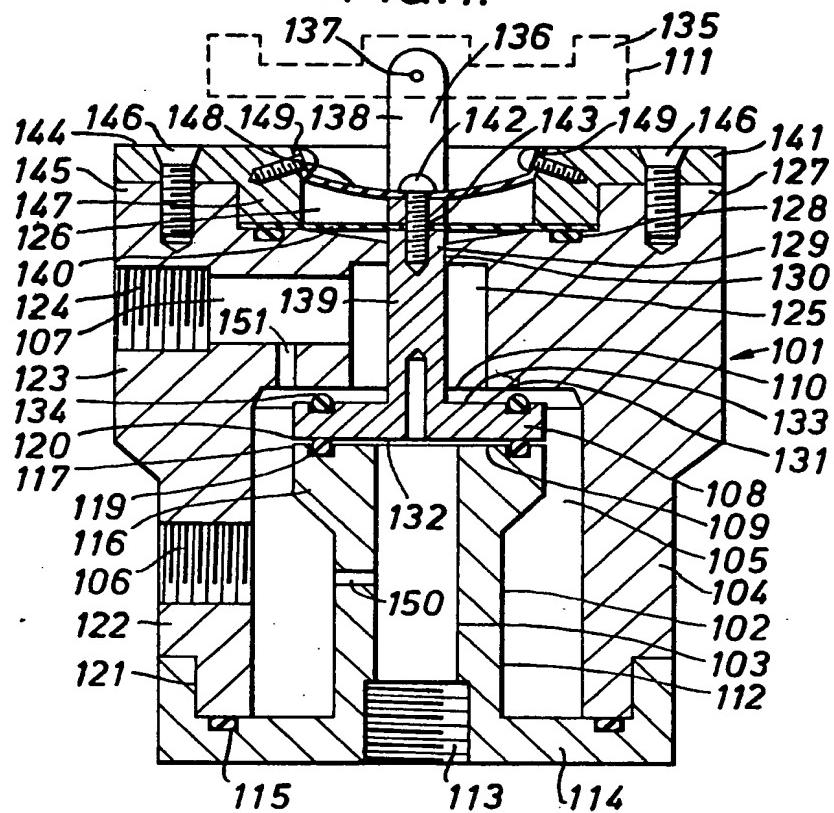


FIG. 2.

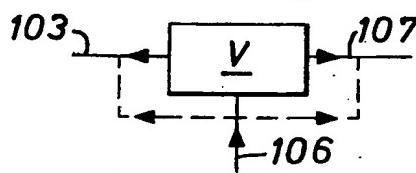
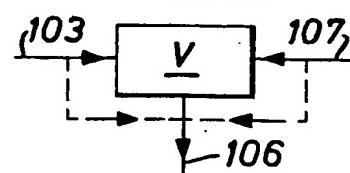


FIG. 3.



SPECIFICATION

A valve for controlling fluid flow

5 The present invention relates to a valve for controlling fluid flow.

The present application is divided out from the parent application, UK Patent Application No. 8235634.

10 According to the present invention there is provided a valve for controlling fluid flow, the valve comprising a body with a portion forming a central passage for conveying fluid through the valve, a cover which is linearly 15 movable relative to the passage between positions where the passage is open or closed at one end by the cover and means for forming a flexible seal between the cover and that portion of the body surrounding the closable 20 end of the passage.

An embodiment of the invention will now be particularly described with reference to the accompanying drawings in which:

Figure 1 is a side view in section of the 25 valve,

Figure 2 is a schematic view of the valve when functioning in one mode, and

Figure 3 is a schematic view of the valve 4 when functioning in another mode.

30 Referring to Figure 1, the valve comprises a body 101 with a first or inner portion 102 forming a passage 103 to receive and discharge fluid, a second or outer portion 104 forming a chamber 105 with the portion 102, 35 the portion 104 having a threaded port 106 and a fluid flow passage 107 communicating with the chamber 105, a valve member 108 for closing off either the uppermost end 109 of the passage 103 or the lowermost end 40 110 of passage 107 and means, in the form of an electric solenoid 111, for moving the valve member 108 away from the end 109 of the passage 103.

The portion 102 is very similar to the portion 2 of Figures 1 and 2 in published UK Patent Application No. 2131917A and has a tubular central part 112 formed with the internal passage 103, the passage 103 having an internally threaded end 113 opposite the uppermost end 109. The portion 102 has a flanged disc 114 forming a seat for the portion 104, the disc 114 having an annular recess to locate a nitrile rubber "O" ring seal 115 with which the portion 104 forms a seal.

55 The tubular central part 112 has an upwardly flared part 116 terminating in an upper end 117 in which the bore end 109 is formed. The upper end 117 of the tubular part 112 is formed with an annular end face 118 which is 60 provided with an annular recess 119 circumscribing the end 109 of the bore 103. A valve member sealing means in the form of nitrile rubber "O" ring 120 is located in the recess 119 with part of its surface projecting 65 above the end face 118 so as, in use, to be

engageable by the valve cover 108.

The portion 104 is generally cylindrical and forms a generally annular chamber 105 with the portion 102. An intermediate part of the portion 104 is provided with the internally threaded port 106 while a lower part has a narrowed annular neck 121 to engage with the seal 115 when the flanged disc 114 is received in the recess formed between the neck 121 and the main body 122 of the portion 104.

The main body 122 of the portion 104 is formed with an upwardly flared end 123 which is provided with the fluid flow passage 80 107 which communicates with the chamber 105. The passage 107 comprises a first part 124 extending inwardly from the outer wall of the portion 104 and a second part 125 formed as a vertical bore which communicates 85 with the annular chamber 105. The first part 124 is partially internally threaded at a position adjacent to the outer wall of the portion 104.

A circular recess 126 is formed in the uppermost face 127 of the portion 104. This is itself provided with an annular recess to receive a nitrile rubber "O" ring 128 which is dimensioned to project above the level of the face of the recess 126. The recess 126 and 95 the second passage part 125 communicate by way of a central bore 129 through which, in use, the stem 130 of the valve cover 108 slideably and sealingly extends.

The valve member 108 comprises a disc-shaped valve shoe 131 from which the valve stem 130 upwardly extends. The shoe 131 has a planar lower face 132 which, in use, engages with the "O" ring 120 in one lowermost position to close and seal off the upper end 109 of the bore 103. The shoe 131 also has an upper face 133 which is provided with an annular recess to receive an "O" ring 134 which is dimensioned to project above the level of the face 133 so that, in use, in an 110 uppermost position the shoe 131 forms a seal with the surface surrounding the bore 125 to close off the bore 125. The arrangement is such that when the shoe 131 seals off the end 109 of the bore 103, the passage 107 is 115 open to the chamber 105 while when the shoe 131 seals off the end 110 of the bore 125 the passage 103 is open to the chamber 105. However, the shoe 131 can be moved to an intermediate position between the bores 120 103 and 125 where the seals are both broken and the bores 103 and 125 simultaneously open to the chamber 105.

The valve stem 130 is connected at its uppermost end to the movable armature 135 of a solenoid (not shown) which is of similar construction and operation to that previously described in relation to the valve of Figures 1 and 2 of published UK Patent Application No. 2131917A. The stem 130 has spaced ears 136 like the support member 23 of the previ-

ously described valve and these ears 136 are connected to the armature 135 via a connecting pin 137 in a similar manner.

The stem 130 comprises uppermost and 5 lowermost portions 138 and 139 respectively, the uppermost portion 138 incorporating the ears 136.

A stainless steel annular diaphragm 140 is clamped centrally between both the upper- 10 most and lowermost portions 138 and 139 of the valve stem 130 and peripherally between the outermost portion 104 and a clamping ring 141. A clamping screw 142 extends through a threaded bore in portion 138 of the 15 valve stem 130 and the central aperture 143 in the diaphragm 140 and terminates in a threaded blind hole in portion 138 of the valve stem 130. In use, the diaphragm 140 rests on and compresses the sealing ring 128 under a 20 compressive force exerted by the clamping ring 141. The diaphragm 140 thereby seals the upper end of bore 125.

The clamping ring 141 is provided with a peripheral flange 144 which is screw clamped 25 to a peripheral annular edge 145 on the upper face 127 of the portion 104 by means of eight circumferentially spaced countersunk screws 146 (only two shown) which extend into suitably threaded blind holes in the edge 30 145. The clamping ring 141 has a neck portion 147 located within the recess 126 in the uppermost face 127 of the outer portion 104, the neck portion 147 engaging with the dia- phragm 140.

35 The clamping screw 142 also clamps a leaf spring 148 to a stepped portion on the uppermost portion 138 of the valve stem 130. The ends of the leaf spring 148 are secured by screws 149 to the internal periphery of the 40 clamping ring 141. The spring 148 tends to bias the valve 108 downwardly so that the valve shoe 131 engages the seal 120 so as to close off the passage 103 and fully open the passage 107. The valve shoe 131 can be 45 lifted by the armature 135 against the spring bias when the armature 135 is attracted towards the core (not shown) after the solenoid coils (not shown) have been energised. Eventually, if lifted far enough, the "O" ring 134 50 will engage the surface surrounding the bore 125 to close off the passage 107 and fully open the passage 103.

Referring to Figure 2, in this example of valve operation, port 106 serves as an inlet 55 for fluid to the valve "V" while the passage 103 and 107 serve as outlets for the fluid. In this case the valve could be operated in the manner of a flow diverter with fluid flow being diverted into either the passage 103 or the 60 passage 107 depending on the position of the valve shoe. The circuit shown in figure 3 would provide the required solenoid control to enable such an operation to be performed. Alternatively the use of a more sophisticated 65 "modulating" circuit (as previously mentioned)

would enable the valve to be operated as a flow proportioning type device. In this case in response to a variable current provided by the control circuit the valve shoe could be positioned between the ends 109 and 110 of the passages 103 and 107 respectively as to enable fluid to enter both the passage 103 and the passage 107 at rates dependent on the position of the shoe 131 relative to the ends 70 of the passage 103 and the passage 107.

The wall of either or both of the passages 103 and 107 adjacent to the chamber 105 is provided with by-pass ports 150 and 151 (see Figure 4) similar to port 21 in the valve 75 of Figures 1 and 2 of published UK Patent Application No. 2 131 917 A to cause the valve to operate in a HIGH/LOW proportioning mode with fluid still able to enter one or both of the passages (as the case may be) at a low rate when the main flow has been shut off by the shoe. The by-pass flow is shown schematically by the broken lines in Figure 5.

Referring to Figure 3, in this example of valve operation, the port 106 serves as a 80 common outlet while the passages 103 and 107 serves as dual inlets. In this case the valve "V" could be operated in the manner of a fluid flow selector with the appropriate fluid inlet being selected when it is open to the 85 chamber 105 while the other is closed by the valve shoe. Here again the circuit shown in Figure 3 of published UK Patent Application No. 2 131 917 A can be used to provide this type of control function. Alternatively the use 90 of a more sophisticated "modulating" circuit would enable the valve to be operated as a mixing device. In this case the valve shoe could be positioned between the ends of the passages 103 and 107 to enable fluid from 95 both inlets to enter the chamber 105 for mixing. The relative proportion of the fluid ingredients would depend on the relative position of the shoe, which position itself could of course be continuously varied in dependence 100 on signals from external sensors serving the control circuit.

In this case, should the valve contain any 105 by-pass port(s) similar to those previously described, the valve would operate in a HIGH/- LOW mixing mode, with fluid still able to enter the chamber at a low rate from one or both (as the case may be) of the passages 103 and 107, when the corresponding main flow has been shut off by the valve shoe.

110 Again the bypass flow is shown schematically in broken line.

It will be appreciated that in the foregoing variants of the applicant's valve:

- (i) The valve can alternatively be operated 115 by an actuator comprising a fixed armature and a moving core/coil assembly.
- (ii) The valve can alternatively be operated by an actuator of a type other than electromagnetic, for example, pneumatic, hydraulic, magnetic, bimetallic, thermoexpansive, magne-

- tostrictive, piezoelectric, etc.
- (iii) Changes in the relative positions of valve shoe and passage end(s) can be accomplished either as described, or alternatively by movement of the passage end(s), the valve shoe remaining immobile, or again by any appropriate combination of movements of the valve shoe and passage end(s) jointly.
- (iv) The biassing force to oppose the primary actuator force can be provided by gravity, with or without the assistance of a spring.
- (v) A single circuit can be used to provide the two-state or infinitely-variable control actions described.
- 15 (vi) The valve can be used to control the flow both of gases and of liquids.
- It will further be appreciated that the applicant's valve may embody any appropriate selection of the features described.
- 20 CLAIMS
1. A valve for controlling fluid flow, the valve comprising a body with a portion forming a central passage for conveying fluid
 - 25 through the valve, a cover which is linearly movable relative to the passage between positions where the passage is open or closed at one end by the cover and means for forming a flexible seal between the cover and that portion of the body surrounding the closable end of the passage.
 - 30 2. A valve as claimed in claim 1 in which the body forms a further passage for fluid flow through the valve independently of the central passage, the cover being linearly movable relative to the further passage between positions where the passage is open or closed at one end by the cover and means being provided for forming a flexible seal between the cover and that portion of the body surrounding the closable end of the further passage.
 - 35 3. A valve as claimed in claim 1 in which the body forms a chamber with which the central passage communicates by way of its closable end, the body having an external port leading to the chamber.
 - 40 4. A valve as claimed in claim 2 in which the body forms a chamber with which both passages communicate by way of their closable ends, the body having an external port leading to the chamber.
 - 45 5. A valve as claimed in claim 3 or claim 4 in which the central passage communicates with the chamber by way of a port having a smaller area than the passage.
 - 50 6. A valve as claimed in claim 4 in which the further passage communicates with the chamber by way of a port having a smaller area than the further passage.
 - 55 7. A valve as claimed in any of the preceding claims in which the cover is mounted on the body so as to be movable relative to the body.
 - 60 8. A valve substantially as hereinbefore de-

scribed with reference to Figures 1 to 3.

CLAIMS

Amendments to the claims have been filed,

- 70 70 have the following effect:
- Claims 1-8 above have been deleted or textually amended.
- New or textually amended claims have been filed as follows:
- 75 75 Claims 9 above have been renumbered as 7 and their appendancies corrected.
1. A valve for controlling fluid flow, the valve comprising a body defining two passages and a common chamber communicating with each passage, one of the passages being located within the chamber, the passages and chamber permitting fluid to be conveyed through the valve, each passage communicating with the chamber by way of an end which
 - 80 80 is closable by means of a common valve member, there being a flexible seal provided between the valve member and the respective end of each passage, the closable ends of each passage facing each other, the valve member being located between the closable ends for movement relative to each of the ends, and being movable normally to the end of each passage between positions Where the closable end of one passage is open while the closable end of the other passage is closed and vice versa and the valve body having external ports leading respectively to the passages and to the chamber.
 - 85 85 2. A valve as claimed in claim 1 in which each passage is defined by a portion of the valve body.
 - 90 90 3. A valve as claimed in claim 2 in which the portion has means by which the passage can communicate with the chamber independently of the closable end of the passage.
 - 95 95 4. A valve as claimed in claim 3 in which the means comprises a port.
 - 100 100 5. A valve as claimed in claim 4 in which each port in each passage portion has a smaller cross-sectional area than the bore of the passage.
 - 105 105 6. A valve as claimed in any of claims 1 to 5 in which the flexible seals comprise "O" rings.